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POPULAR MECHANICS

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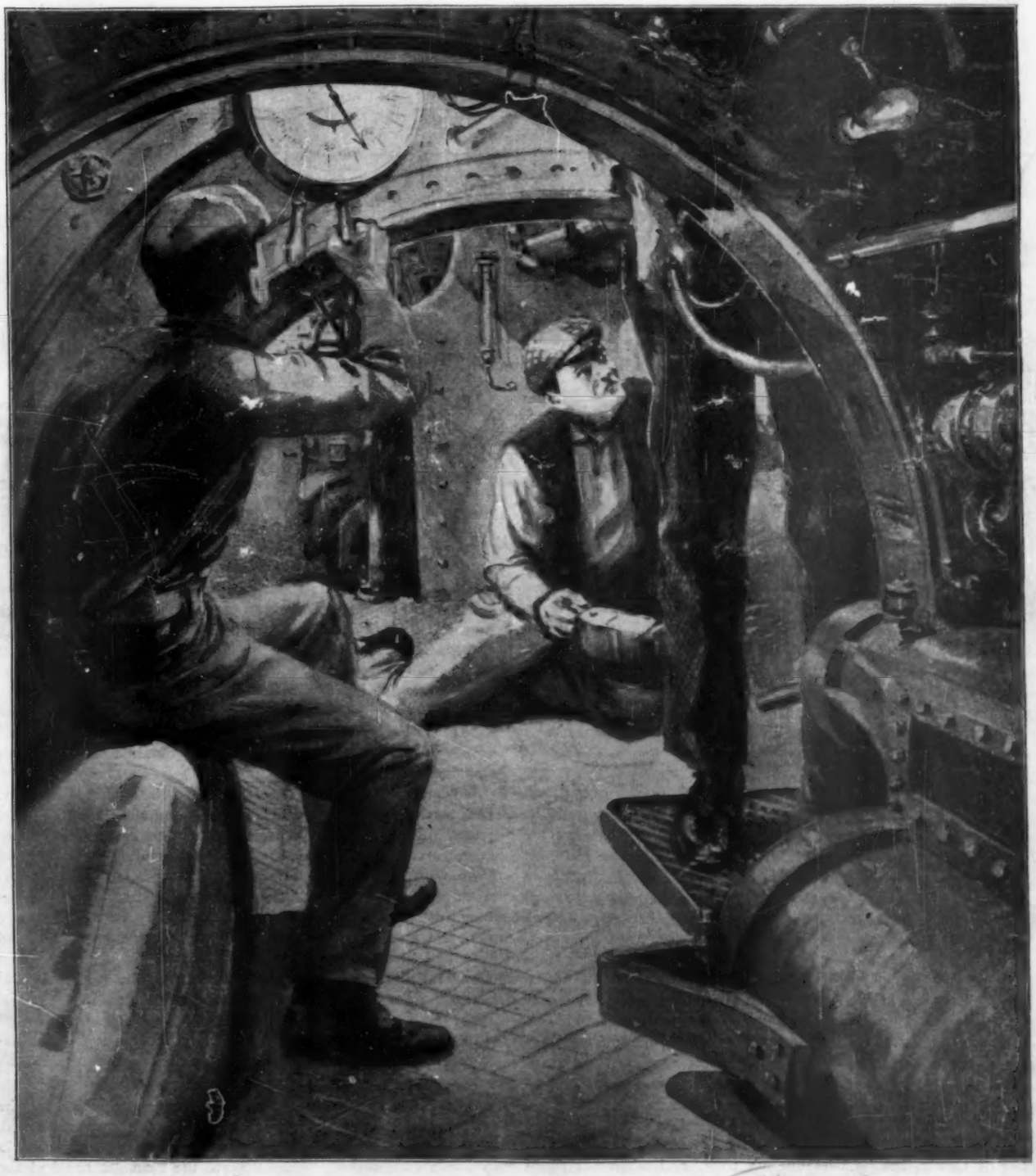

INTERIOR FIRST SUBMARINE BOAT FOR BRITISH NAVY

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PUMPING WAR RELICS.

On the shore of Sabine Pass, which is on the Gulf coast of Texas, not far from the Louisiana line, may yet be seen the remains of a famous "mud fort." Directly in front of the old fort the Government is at present dredging a deep water channel. The work is done by means of immense pumps on scows, which suck up the sand and mud and discharge through a pipe leading to the shore. An eye witness send us an account of what occurred there a few days ago.

The dredge Chas. Clark No. 4 pumped out a quantity of stuff which would make interesting relics in many of the Confederate camps. The dredge was in the locality where the Federal gunboat Clifton was disabled and captured by Dick Dowling and his men—42 in number, Dowling included—on the 8th of September, 1863, when in their little mud fort, with four formerly condemned guns, they captured the Clifton, with all on board, disabled the gunboat Sachem, causing her to sink at sea, and turned back two other gunboats and 22 transports with 16,000 men, who were attempting to invade Texas. Suddenly the discharge pipe began shooting out leather belts, pistol and sword scabbards, knapsacks, brass sword hilts and buckles, parts of guns and bayonets, and shot and cartridges of various kinds and sizes—equipment thrown overboard by the surrendering troops on the vessel, pending the time she was disabled and their bringing her to anchor under the white flag. Among the articles pumped through the 1800-ft. flume by the dredge, was a brass pistol, which looks little the worse for its rest of 38 years beneath the waters of the Pass. Another well preserved relic of that eventful episode is a leather cartridge box on which the manufacturer's name and address is plainly inscribed.

CASEHARDENING.

The process of casehardening really consists of two processes. First, the surface of the piece, whatever it may be, and so on to a greater or lesser depth, depending upon the process employed, is changed very definitely from iron to steel; then this surface is hardened as any steel is hardened. There is surprisingly little difference as between iron and steel—that is, between a bar of good iron and a bar of steel—so far as the constituent parts are concerned; yet this little difference constitutes the important distinction between something that will "cut like a razor" or that may be tied up in a knot, like a whip lash.

The first process in what will always be called case-hardening is the supplying to the iron—the surface of the piece under treatment—what it lacks to make steel of it; otherwise it will not harden. The principal thing to be supplied is carbon, one of the most common of all substances.

Cast iron is made up, generally, of not less than 3 per cent carbon. For the purpose of converting this into wrought iron an essential part of the process consists in getting rid of the carbon—burning it out. In the process of converting the wrought iron into steel, some of the carbon must be restored; the wrought iron must be recarbonized. In the first process in casehardening the surface of the wrought iron is kept in intimate contact with something that will supply the carbon to the iron when the latter is at a fairly high temperature.

For casehardening superficially—that is, for converting into steel a thin film of the iron only,—the operation is all in the open air, which makes it imperfect in every respect. Prussiate of potash is very commonly employed. If the piece is well polished, and reasonable care is taken, a fairly fine mottled-grey surface is obtained. When the process is employed for small pieces at frequent intervals the potash may be kept in any suitable iron vessel. The piece to be hardened is dipped into this and stirred about, an old spoon being used to keep it covered with the potash. When the piece cools somewhat it is again heated slowly, the potash adhering to it, and when hot again treated with the potash, then heated as for tempering a piece of steel and plunged into water. The heating and covering with potash may be repeated three or four times, or more, if a little deeper hardening is desired.

Where casehardening to a considerable depth is desired, the pieces are packed in suitable iron box or pot, along with equal parts of charcoal, pulverized bone, and leather scrap. Or instead of this, saltpetre and leather may be used, in the proportion of 1 pound of the former to eight pounds of the latter. First, a layer of the mixture is put in the bottom of the box, upon which a layer of the pieces to be casehardened is carefully placed so as not to touch one another or the sides of the box. Over this another layer of the mixture is placed. Then another layer of the pieces, and so on till the box is filled. The cover is then put on and the joint luted with clay, to exclude the air. The box and its contents are then kept at a red heat for from three to five hours longer, according to the depth it is required to harden. It is then uncovered and the contents dumped into a tank of clean, cold water with the least possible exposure to the atmosphere. In this way the hardening may be to a depth of 1-12 in. or deeper, which is necessary for pieces subjected to very considerable wear. This leaves a very hard surface, with a soft centre, not likely to break by shock.

Large pieces casehardened in this way are sometimes found to have the metal beyond the hardening weakened in the process —granulated or something of the sort. To remedy this some practice annealing after casehardening, then heat and cool the same as in tempering steel.

Iron that is to be casehardened should be homogenous in quality—that is, not of piled and welded scrap. If this precaution is not observed, the pieces will very likely come out badly sprung out of shape. The quality of the iron should be good.

When a good deal of casehardening is done, a special furnace is very commonly employed, in which the boxes or pots are placed for heating.

ADVANTAGE IN LEARNING FRENCH, GERMAN AND SPANISH.

A leading American manufacturer, who has a large export trade, says not enough attention is given to foreign languages. I am asked the question nearly every day in Europe, "Where can I get some bright young machinery salesman, speaking English, German and French?" and I tell them, "I don't know," and "If I did I would not tell you, but take him myself." Let me say to our young men that the stepping stone to greatness in a commercial career is through the selling department. There is no branch of a business that requires as high an order of ability as the placing of its product. Every manufacturer will bear me out that it is more difficult to obtain first-class salesmen than any other class of men.

We have had occasion to refer to the East India Company. They sent out from England a bright young clerk and salesman, named Clive. He combined with his commercial training great executive ability. There was an uprising of the natives, and Clive, without military training, with a handful of men from his office, quelled the rebellion. He was afterward given the command of troops in another part of the country, defeating a force of 60,000 men with but 3,000. He was made Lord Clive, and laid the foundation for that great empire. Our young men should at once organize night classes for the acquisition of German, French and Spanish. It will not be long before it will be absolutely necessary for correspondents, typewriters and others in offices of large manufacturing concerns to have an intimate knowledge of these three languages.

An American being shown over an English estate by the head gardener, and impressed by the handsome lawn, remarked, "It must have required quite a little work to get this lawn in so fine a condition." "Yes," replied the man, "it has had the best of care for over 200 years."

TURNING NIGHT INTO DAY.

MIDNIGHT PHOTOGRAPH TAKEN BY LIGHT OF ELECTRIC HEADLIGHT.

The lightning express plunging through the night at 100 feet a second requires an intense and far reaching light. Electricity has made such a light possible and already many roads have adopted electric headlights. Roads operating in mountainous districts where danger lurks in landslides and washed out bridges, or lines traversing tracts where stations are far apart have been the first to equip. The light is an arc lamp, with a powerful reflector, and current is supplied from a small generator carried on the locomotive. On a dark night it is possible to view the track even better than during the day, as the light is concentrated on the rails. It is often easy to count the telegraph poles for a distance of one mile where the track is straight and level. Our illustration is from a photograph taken at midnight by the light of an electric headlight.—Railway Age, Nov. 22, 1901.

QUICKSAND.

Very little is known by the general public about quicksand, and that little is usually obtained from novels. Such information is usually wrong, being composed of a pinch of truth and a handful of fiction. The sensational novel goes so far as to give to quicksand some attributes that belong only to living creatures. No ordinary observer could distinguish quicksand from any other if it were dried; and if he wished to restore its fatal property artificially, he would, in all probability, fail. Suppose he fills a bucket with it in the dry state, and soaks it with water; it does not in consequence become mobile. If he drains the water off from the bottom, the sand will be found wedged firmly in place, and if the water be measured it will be found to equal thirty per cent of the bulk of the sand, or about twenty per cent of its weight. From this we may infer that a cubic foot of dry sand weighs nearly 94 pounds. This, for sand, is very light weight, for there are other qualities of sand which weigh as much as 171 pounds. Quicksand, when examined under the microscope, will be seen to have rounded corners like river sand, as distinguished from angular or "sharp" sand, which will pack more solidly than the other. It is quicksand that is used in the hour-glass and in the smaller egg-boiler, partly because of its fineness and partly because it does not obscure the inner surface of the glass by scratching. The lightness of quicksand is the quality which will lead us most surely to the cause of its reputation, and to illustrate this, the bucketful of sand must be loaded with water from below, and made to overflow very slowly. The upward current will be found to loosen the sand and to raise the surface very slightly, separating and lubricating the particles so that they are easily displaced. The bucket now contains quicksand, and this sand, from the support it receives from the water, has its weight or supporting power reduced. In the dry state it weighed nearly 94 pounds, but if weighed in the water it is reduced to 32½ pounds, and its mobility prevents any animal from walking on it. The mixture of sand and water weighs quite 112 pounds per cubic foot, or nearly twice the weight of water, and bulk for bulk nearly twice the weight of a man, but it is too thick to swim in, and the person engulfed would soon be too exhausted to escape. He would probably die of suffocation if not drowned by an advancing tide, for quicksands are found mostly within the influence of tides. He would not be swallowed by the quicksand, because it is so much heavier than his body. Quicksands require in all cases an upward current which is not quick enough to form what is called a spring or fountain. It may be formed in two ways—in tidal rivers and on the shores of tidal seas the rising tide may saturate a porous stratum of ground below high-water mark, and when the tide falls a return current is established through the same porous (sandy) ground with a sufficient velocity to loosen the sand, as above described. This sand, as soon as the rising tide reverses the current, ceases to be "quick." The other case is that when a slow current of fresh water finds an exit through a surface of sand above or below water. This is a permanent quicksand. Any sand and almost any material might have the quality of quicksand imparted to it by means of a suitable current.

SEEING BY WIRE.

Seeing by wire is the latest improvement in modern conditions, according to information that comes from Brussels. Dr James Sylvestre, an American, is said to have given practical tests there of a spectograph he has invented which enables a person using a telephone to see the interlocutor and the latter's surroundings. The instrument also works on an ordinary telegraph wire, the inventor claims, and he hopes to make it practicable for use on cables enabling a person to see as well as talk across the ocean. If the professor's device is a succees it will soon be possible for persons to see each other while they are talking over the wire between Chicago and New York.

The French minister, it is claimed, has witnessed conclusive tests of the invention and King Leopold has arranged a special audience with Dr. Sylvestre for the purpose of inspecting the instrument and witnessing its operations.

ELEMENTARY STUDIES IN ELECTRICITY.

CHAPTER I.

Electricity exists in two forms—as a stationary charge, and as a moving current. The former is not of much practical value to us, while the latter is of immense value. It is the electric current that runs our street cars and lights our houses, and enables us to do the many other wonderful things with which every one is more or less familiar. There are at least three methods by which this electric current may be produced, two of which are in every day use. One of these methods is to use a Voltaic cell, or battery, and the other method is to generate the current by means of a dynamo driven by a steam engine or other source of power. When we wish to use the current on a large scale, the dynamo method is much the cheapest to use. But for all purposes where only a small amount of current is needed, it is much cheaper to generate it by means of a battery.

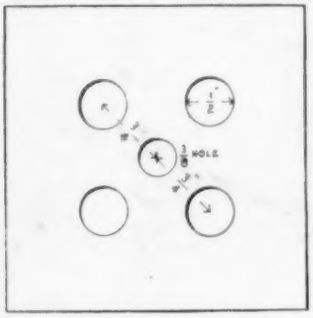


FIG 1

A powerful and efficient battery for experimental purposes can be made by any amateur at an insignificant cost. For this purpose, there will be needed four tumblers (the kind with vertical sides) about 2½ inches in internal diameter; four pieces of pine ½ inch thick and 3 inches square; four zinc rods ⅜ inches in diameter, such as may be bought at any electrical supply store at a cost of a few cents each, and 16 carbon rods, ½ inch in diameter and 5 inches long, such as may be picked up under any electric street light.

Cut a piece of board three inches square and ½ inch thick. In the center bore a ⅜-inch hole; ¾ from the center of this hole bore four other holes ⅜ in diameter and equally spaced around the central hole. (See Fig. 1.) File every trace of copper from the surface of the carbon rods (if they are copper plated) and having filed them to a length of 5 inches, push four of them through the ½ holes so that they project 3½ inches from the lower side of the board. They should fit snugly, and be wedged in if necessary.

In a tin dish, large enough to admit the board which forms the top of the cell just made, melt some paraffine wax until it just begins to smoke, taking care not to heat it hot enough so that it will take fire. Immerse the board and the short projecting ends of the carbons in this hot wax, leaving it there for five minutes. Do not immerse the long projecting ends of the carbon in the wax, nor get the wax on these ends, for this will impair the efficiency of the cell. The object of the wax is to make the board and the upper ends of the carbon rods, impervious to acids and moisture

Remove the board and carbons from the wax, shake off the superfluous wax and let them drain bottom side up, until cool. We have now four carbon rods, mounted upon a paraffined board, the whole forming one pole of our cell. A zinc rod forms the other pole, and one of them should now be pushed through the hole in the middle of the board, until it projects the same distance from the lower side of the board as the carbon rods do. The zinc must not touch the carbon rods, as this would spoil the action of the cell.

All that is left to do now is to connect the carbon rods with each other. An easy way to do this is to take a piece of bare copper wire (not insulated), about six feet long, and wrap it tightly around one carbon about ten times, then carry it on to the next, wrapping it around the second, then on to the rest of the carbons. All wax should be scraped off before this is done until a clean carbon surface is obtained. After wrapping the wire around the fourth carbon, twist it about itself two or three times, and carry the loose end to a binding post screwed to one corner of the board. Insert the apparatus just constructed into one of the tumblers, and one of the cells is complete, with the exception, of course, of the liquid which is to be used. Its appearance is shown in Fig. 2. Proceed in this manner with each of the other cells. Four is a sufficient number of cells for most purposes, although the amateur may wish to make more for special purpose.

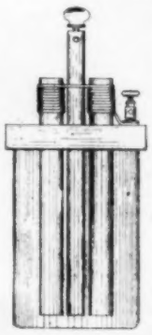


FIG 2

A liquid for use in these cells can be made as follows: Dissolve 8 oz. of bichromate of potash in two quarts of hot water. When cold add 8 oz. commercial sulphuric acid. A caution must be given regarding the use of this acid. First, never let it touch the fingers or clothing or any similar article. It will destroy them like fire. Next, never pour water or any solution into the acid. Always pour the acid very slowly into the water, stirring constantly. On account of the destructive qualities of this acid, it is almost imperative that the tumblers containing it should stand on some sort of a tray. This may be made of a shallow wooden box about one inch deep, thoroughly soaked in paraffine. Whenever the battery is not in use, the carbons and zinc rods must be removed from the acid and set aside to drain. The tray should be large enough for this purpose. In using the cells, connect the carbon terminal of the first cell to the zinc of the second, the carbon of the second to the zinc of the third and the carbon of the third to the zinc of the fourth. This will leave free the zinc pole of the first cell and the carbon pole of the fourth cell, which will form the terminals of our battery.

In a later paper, we shall see how we may, by a little extra work,, improve the working of these cells, and how we mav perform many interesting experiments with them.

(To be continued.)

VESTADIUM—A NEW METAL.

A new aluminum alloy has recently been introduced by a firm in Birmingham which is said to be not only of pleasing appearance, but to be possessed of considerable strength. The inventors claim that their new metal, which is to be called "vestadium," is very much stronger and of far greater utility than any metal of the same specific gravity at present known. Vestadium is an alloy of aluminum, with a specific gravity of 2.73—that is about one-third the weight of steel of the same volume, and is, therefore, of about the same specific gravity as pure aluminum, which is the lightest metal in mercantile use. A tube of the metal, 12 inches long, was fixed with one end against a support, and pressure applied to the other end; the tube only commenced to yield when a pressure of over 4,800 pounds had been applied, and was only very slightly crushed at a pressure of more than 5,000 pounds. One of the great advantages which these tubes possess is that they never snap. Vestadium is non-corro

sive, the atmosphere and water take no effect upon it, and sulphuric acid does not even mark it. In color it is said to be whiter than silver and takes a magnificent polish, which does not tarnish and requires very little cleaning.

GUM CHEWING VS. FOOD CHEWING.

Chew your food thoroughly. Mix it well with saliva. Don't rush through the meal—it comes but three times a day and you are entitled to be leisurely about it. Enjoy it, says the Osteopathic Physician. Take your time and do it well. Very much of the dyspepsia, headache and constipation of the world comes from bolting one's rations. The dog's stomach is made to take care of food gulped down in "original packages;" yours is not. You must eat in a human way or pay an inhumane penalty.

Do not be led into the error of thinking that gum-chewing aids digestion. It does not. But food chewing does. The digestion of food begins in the mouth by its admixture with saliva. Failing properly to treat the food with this digestive juice while in the mouth cannot be compensated for by any amount of insalivation induced artificially afterwards.

Gum chewing, moreover, is a great drain upon the salivary glands. Three pints of saliva a day is the average capacity of these little glands. Under the stimulation of habitual gum-chewing this output is said to reach as high as six to eight quarts. This drain on the nervous system and glands, it can well be seen, is enormous.

The habit of chewing gum when practiced immoderately also induces weakness of vision. Bookkeepers and others, who are apt to chew steadily while they work, at the same time that the eyes are used actively, are very apt to suffer from eye-strain. It is nerve waste that affects the eye sympathetically in many such cases.

So the person who chews gum in the delusion that he is aiding digestion is working overtime in a bad cause and inflicting decided damage upon his system.

TO CLEAN SPONGES.

To clean old sponges, boil them for three or four hours in water (enough to cover them) containing a couple of tablespoonfuls of carbonate of soda, or in water mixed with a couple of handfuls of wood ash, this to remove all the greasy matter that the sponges may contain; then rinse them thoroughly, squeezing them well in several lots of clean cold water. After this preliminary operation soak the sponges in chloride acid, mixed with four times the quantity of water, suiting the whole amount to the size of the sponge, but keeping the same proportions. After twenty-four hours let water run on to the sponge for some time, then rinse with the hands until the smell of the acid has disappeared. Hang the sponges up to dry over a hot stove, and when this has been satisfactorily accomplished, the sponge will be almost as good as new.

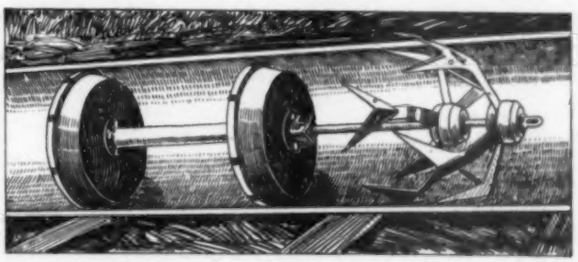
TESTING FEED WATER.

Treatment of feed water by an engineer has not, as a rule, met with any great success, as a number of experiences in this line that have been shown up will testify, but there are a few tests that everyone having charge of boilers should be familiar with. The presence of hard or soft water is easily detected by dropping a few drops of alcohol that has dissolved all that it can possibly hold of good soft soap. The water will turn milky white if it is hard, and remain clear if soft. Add to the water from five to ten drops of oxalate of ammonia in a test tube. If carbonate of lime be present the water will in a short time present a clouded or milky appearance, and in a few hours a precipitate will be found at the bottom of the tube. Take some of the feed water and add a few drops of nitrate of baryta or barium cloride. If sulphate of lime or sulphuric acid is present, it will be shown by a milky appearance, and by the formation of a white precipitate. If decomposed animal matter is the cause of all the trouble, it will be shown by adding a drop of permanganate of potash, which will color the water a bright violet rose when first added. If decomposed organic matter is present the color changes to a dull yellow; if present in large quantities, however, the color will in time disappear. If, upon adding a few drops of solution of prussiate of potash a blue color is produced directly or after some time, it shows that iron is held in solution.—Mechanical World, London.

CLEANING A WATER PIPE.

When the underground pipes which supply a city with water become foul with incrustations or choked with sediment it is often a serious problem to remove the obstructions. Such a predicament occurred at St. Johns, N. B., and one morning a portion of the city containing 8,500 inhabitants was suddenly deprived of water. The situation was serious and full of danger. The main which was laid in 1851, was 24 inches in diameter and five miles long, bringing water from a lake which is 160 feet above the city. To remove the pipe was too slow and expensive a matter, and after several unsuccessful attempts a machine was devised which quickly cured the trouble.

Two pistons were made of birch using several layers one inch thick, and built crosswise to prevent warping and increase strength. Discs of thick leather were bolted to the pistons, making a snug fit in the pipe, but allowing some play. A spindle made of 3-inch wrought-iron pipe connected the pistons and extended two feet in front. On the end of the spindle were attached four arms made of spring steel and sloping backward in fish-tail form. These arms were so placed as to cover the entire surface of the main, at the same time avoiding too great resistance at any one point.



In describing the working of the device the Canadian Engineer says a section of the main extending from the reservoir toward the city, a distance of about 6,000 feet, having been prepared by inserting a hatch-box at each end, the work of cleaning began. The head of water upon the upper hatch-box was 20 feet and on the lower 27 feet. The first run took four hours, for the reason that a cord sufficiently long to reach the whole length had been placed on a revolving drum 10 feet in circumference, and furnished with an indicator to register the revolutions. The end of this string was attached to the cleaner, and a record kept of its location as it sped along. But when the first flushing branch was reached the twine drifted out here and down the brook, while the drum kept on revolving and the indicator registering until the whole string was paid out. Meanwhile the cleaner had become securely moored near the flushing branch and could not be liberated until the stop-cock was dug to and uncovered. On the twine being cut and pulled out and the stop-cock lid restored, water was let on again and the cleaner finished its journey, a distance of 2,200 feet in about five minutes. This first run was sufficient to show that twine was dangerous, and entirely unnecessary, for the grating sound of the cleaner as it passed through the pipe was heard quite distinctly by the two watchers under their feet as they followed the sound along the line. Two more

runs were given, the time occupied to go the distance being about twenty minutes. The water was inky black for some time as it flowed from the flushing pipe, and it was allowed to run for two hours after the cleaner had been removed, this time having been required for the water to clarify. The process was continued until the flow of water was as great as when the main was laid, half a century ago.

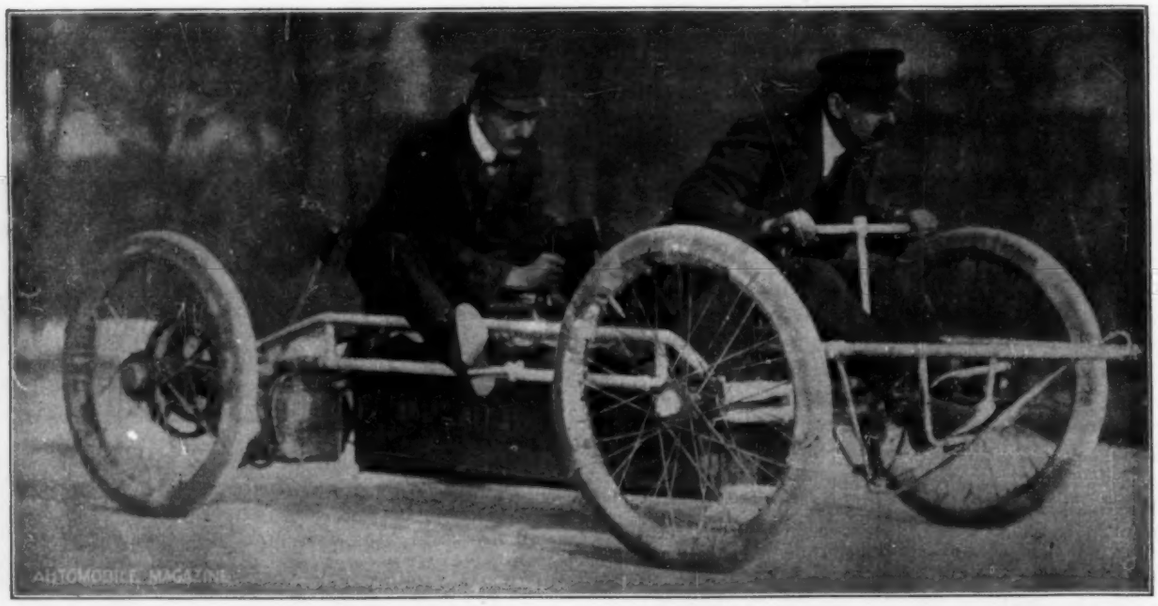
BREAKS ALL RECORDS OF ELECTRIC AUTOS.

All records of electric machines were broken by A. L. Riker's low-rigged racing frame in a contest between members of the Long Island Automobile Club, on Coney Island Boulevard, in Brooklyn. Mr. Riker finished a mile in 63 seconds. The machine was stripped down as far as was possible and presented the appearance of a mere frame. Onlookers thought it made much better time than it really did, because it was so low and there was so little display and noise. It was in striking contrast to the ponderous looking machines of other of the contestants.

The three fastest machines in the race were those of Henry Fournier, Foxhall P. Keene and A. C. Bostwick, all gasoline. The best time was 51 4-5 seconds.

"The performance of the three fastest machines," says the Automobile Magazine, from which the accompanying illustration is taken, "were very even. Each driver had several trials, and several had to take more than their allotted number on account of the timers being confused.

"Mr. Riker went back for a start only about 200 yards from the point time would be taken, he being towed there. He gathered headway with surprising alacrity. All others, especially the heaviest class, went back to distances varying from ¼ to the full mile allowed them. Mr. Davis brought out a racing locomobile, having steaming capacity which should satisfy any one. The vehicle looked as though it would do something great and under Mr. Davis' control it went faster than any steam automobile has yet traveled in America."



ELECTRIC AUTO MAKING ONE MILE IN 63 SECONDS.

A workman in a Toledo elevator made picture frames from wornout wooden spouts, the inside of which were most beautifully polished by the thousands of bushels of grain. A coat of shellac made the job complete.

TELEPHONES IN THE UNITED STATES.

The Electrical Review for December 14 has a valuable article on the growth and magnitude of telephones in this country. The telephone was invented by Professor Alexander Graham Bell in 1875 and patented by him the next year. At that time good business men considered it would never be of practical use. By January, 1878, some 5000 instruments were in use on private lines. The same year a test conversation was had between New York and Philadelphia, and Philadelphia and Washington. The first exchange was established in 1879. The fundamental patent on the speaking telephone expired in 1893. There are now many concerns manufacturing telephones.

Of independent companies there are now 2811 with 708,717 subscribers, and having $125,000,000 invested. Farmers' and other private lines number 490,000 instruments. The Bell company has 1,500 exchanges with 1,080,000 telephones and an investment of $320,000,000.

Total in United States: Exchanges, 4311; telephones, 2,278,717; investment, $470,000,000.

At the present time the manufacturers are turning out over 3000 telephone instruments daily or over 1,000,000 sets a year, valued at $30,000,000. Wire, poles and other material used to install these phones is $25,000,000 a year.

A NOVEL STEAM BOILER.

Au English engineer has designed a steam boiler made up mainly of coils of steel tubing. The great objection to this kind of boiler hitherto has been that the generation of steam is very irregular, and the coil liable to become choked with deposit from the water. To get rid of these disadvantages the inventor has designed a coil boiler, into which he places small balls which can move freely in the tube for a short distance. These, by checking the flow of water through the lower coils of the tube, permit the steam to come off more quietly, and the violent production of steam, so common with this type of boiler, is prevented. As the balls are in constant movement, all scale and deposit are cleared away, and the tube is thus kept much longer in working order than it otherwise would be. The boiler is intended for use in automobiles and steam launches.

HOW TO SUCCEED IN THE RAILROAD BUSINESS.

An Address by Chauncey M. Depew.

In the early days of railroading it was a vocation, now it is a profession. As the railway sytems expanded the enormous business of each company compelled traffic departments, freight and passenger; auditing, financial, construction, roadbed and bridge departments. The operation of the road called for general managers, superintendents and assistant superintendents; and a lawyer of distinction, supported by a large number of assistants, who should devote themselves entirely to the legal business of the company, had to be employed everywhere.

The railway profession presents more attractions for a young man than any other line of business. It has greater opportunities for advancement, and its employment is more permanent. To succeed in it in any department requires health, brains, honesty and equipment. The young man must make up his mind that if he would rise in the profession, he must never question the kind of work that is put upon him, the hours which are required of him or the places, agreeable or disagreeable, to which he is assigned.

The young man who proposes to enter railway service should first decide whether he will take his chances for a career in outdoor or indoor work. If outdoor work, which is in the operating department, he will be immensely assisted if he has had the opportunities which are offered in the technical schools. In these days of thorough training it is almost impossible for a young man of ordinary education to get on in competition with the graduates of the Sheffield Scientific School at Yale, the scientific schools of Columbia, the special education of Cornell, the big advantages of the Troy Polytechnic and the Stevens' Institute, and the instruction given in many other of the schools and colleges of the United States.

If he selects indoor work, he must make up his mind that much more will be required of him, at first, than in commercial lines. If he is in the treasurer's department, and shows special efficiency and intelligence, when a vacancy occurs in the freight department, in any discussion that should happen between the heads of these departments he is almost certain to be drafted for a better position by the traffic manager, and vice versa.

Railroading differs from no other business or profession in its beginnings. The salary is small. The work is hard. It is only the few who, by cheerful readiness at all times to perform their own tasks and to stay several hours—and, if necessary, all night—to meet the requirements of the office, or to do the work of the lame, lazy and incompetent, attract the attention of their superiors and are marked for promotion.

When once, in any department, the young man has impressed upon the head of it his usefulness and fidelity his career is made. With the rarest exceptions, the heads of all departments in the railway service of the United States have come up from the ranks. The presidents of all the railroads have known the day of small things and been many years reaching their positions. The superintendents have all come from the brakes or from carrying the rod and chain in the engineering service. The superintendents of motive power have come from the footboard. The master mechanics have all come from the bench. Traffic managers and treasurers have all begun as clerks. There are but few heads of departments on our own road who have not risen from the ranks. In the operating department the general manager began as a brakeman, the general superintendent and two of the superintendents as telegraph operators, one superintendent as agent and one as a clerk in the superintendent's office.

Vacancies are the inspiration and hope of those who desire and work for promotion. Sometimes a young man will do very well at first, but as soon as he reaches a place of some importance he overestimates the hold which he has and the strength which he has attained in the confidence of his superiors. He will be often absent from the office. He will take frequent vacations. He becomes restive under rigid hours and overtime. His superior discovers that he often takes advantage of the necessary absence of his chief to absent himself.

In the service everyone's eye is on everyone else. There is a generous appreciation of comradeship; at the same time there is severe criticism of the conduct and character of fellow-employes and officers. The moment an officer becomes careless of his duties, inattentive and out of reach when wanted, his chances of promotion are over; and the accident of a discharge or displacement are imminent. The chief mistake of the ambitious young man is in regarding the necessity for extra effort, care and attention, lessened because he had been promoted to better and more important positions.

It is in these stages of conspicuousness that many a promising railway officer loses all the advantages of his previous hard work, incurs the displeasure or distrust of his superiors and makes it impossible, even if he reforms, to advance him. There is but one rule of success in railway service, and that is, no matter how high you get, once a hustler, always a hustler, a hustler until you die or resign.

TRAVELLING CRADLE FOR PAINTERS.

An English inventor has patented in his own country a wire-supported travelling cradle for use in the painting and redecoration of buildings, and other structures. The cradle depends from and runs along a wire rope or cable. It is raised and lowered, and also worked laterally by means of guy lines, entirely from the cradle. It is lighter and smaller than the ordinary cradles and easily fixed. This cradle was recently used in repainting Southwark-bridge, London, and it was stated that the work occupied less than half the usual time.

TRAVELLING PAINTING PLATFORM.

"BOB BURDETTE" TO THE DENTISTS.

The California Dental Association invited "Bob" Burdette to make an address, which is reported in the Dental Digest. The opening was as follows:

"Man that is born of a woman is of little hair and no teeth when he is born, and sometimes it would be money in his pocket if he had less of either. As for his teeth, he hath recurring convulsions when he cuts them, and as the last one is coming through the first one is falling out; and he entereth the afternoon land of his days, a human machine, having a mouth full of porcelain teeth built upon a plate that is constructed to hold raspberry seeds, so that the last state of that man is worse than the first."

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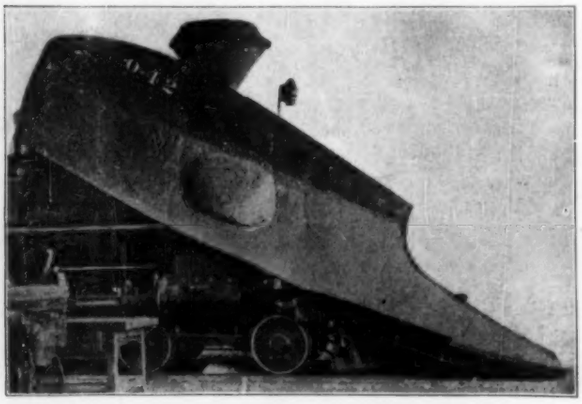
SNOW PLOW IN THE MOUNTAINS.

Fighting snow out in the Rocky Mountains is very serious business and calls for brave men and strong machines. The Railway Review Dec. 14th describes a snow plow now in use on the Union Pacific R. R., in storms where the snow is three feet deep or less. The plow is made of heavy boiler iron and attached as shown in the cut. Two powerful locomotives are required to push the machine.



ROCKY MOUNTAIN SNOW PLOW.

HOW WIRELESS TELEGRAPHY IS WORKED—SIGNOR MARCONI TELLS HIS STORY.

Guglielmo Marconi, who has just astounded the world by sending a message across the ocean without the aid of wires, has on request, made the following statement as to how he discovered wireless telegraphy and the methods employed in its operation:

"I took up Hertz's experiments while living on our family estate at Bologna, Italy. I was not a professional electrical engineer, but just an electrical amateur. The use of the upright wires is my special invention. Hitherto the experiments had been only tried by sending impulses from wires or plates held horizontally, and long parallel lines were usually thought necessary. I argued that the impulses went out in circles and therefore an upright post or wire was what would be required. The first experiments were made from hill to hill on our estate, in little huts, the first at a distance of about a mile and afterward further.

"Now as to how the messages are sent! You understand that an ordinary telegraph instrument works by a current from a battery whenever the wire is connected, by a tapping key or other interference, and it acts by giving dots and dashes for the alphabet. Now if one can arrange a delicate interference of some kind that shall allow the current to pass only some times and not at others, and if we can effect this at a distance, then you will see that though the battery at the other end actually works the telegraph, it is started or stopped from the end here by the vibrations through the air.

"The first thing is to send the vibration through the air. This it done by the upright wire, one end sticking up into the air on a pole or mast. The other requirement is to obtain a delicate interrupter to the actual current from a battery over there on the hill, a mile or twenty miles away.

"This is found in what is called a 'coherer,' which is a little glass tube in which are placed some nickel and silver filings. When this tube is inserted in a circuit, the fillings are usually bad conductors, and will not let the current pass; but if it be placed anywhere within range of the surgings or waves of a high-tension coil, it all at once becomes a good conductor. Therefore if the waves are directed even from a mile or more away and be made to affect this little tube, the 'coherer,' the battery over there will send long and short circuits into the instrument and the telegraph works without wires.

"Since the later demonstrations, installations are contemplated in this country for commercial and military purposes and I am confident that in a few months many more wireless telegraph stations will be established here and abroad."

SUBMARINE CABLE TO THE PHILIPPINES.

"The Commercial Pacific Cable Company would have been very happy to have given an American company its contract, but there is no company in the United States that could, we felt, perform the work. They have not the machinery, and we could not afford to have the work of laying the cable take the form of an experiment. The Silverton company has been established for over 40 years, and has laid most of the deep-ocean cables throughout the world, so that it understands perfectly just how the work should be accomplished. The company has assured us that it will complete the cable and have it here in seven months. Just as soon as this section is complete, and out of the way we shall commence work on another section that will connect the Hawaiian Islands with the Philippines. Our station there will probably be on the island of Luzon and near or in Manila. We have not decided on that point yet, nor have we fixed our schedule of rates, but I may say, in speaking of rates, that we shall reduce them to a reasonable figure. We expect to have the work completed in about two or three years. The estimated cost of the undertaking is about $15,000,000, but we have capitalized our company at only $3,000,000, because we prefer to increase our capitalization as we proceed rather than use such a large figure at the beginning."

It is believed that Mr. Mackay and his associates received assurances from Attorney-general Knox that they would have perfect legal right to make landings in California, Hawaii and the Philippines without permission from the government, and upon this decision the contract for the first section of the cable was placed.—Western Electrician.

A western shipper sent a car load of wheat to Chicago, using a refrigerator car on account of other cars being scarce. When the car arrived 1,200 pounds amounting to 20 bushels, was found missing. Later the grain was found to have shaken into a space back of the ice-box.

HOW TO MAKE A WATER MOTOR.

Will Drive Fan, Generate Electric Light or Run a Sewing Machine.

If you haven't an electric motor in your own house a little mechanical ingenuity, aided by oil cans, a wash basin, a brass tube and other simple paraphernalia may enable you to construct a water motor for yourself. Mr. E. J. Prindle having occasion for a small amount of power in a house where no electricity

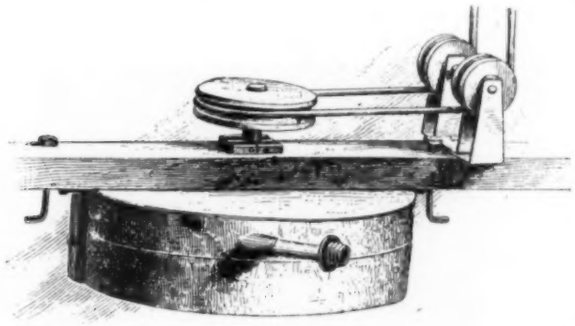


Fig. 1.—Motor in Operating Position

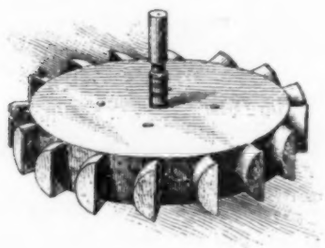


Fig 2.—The Wheel

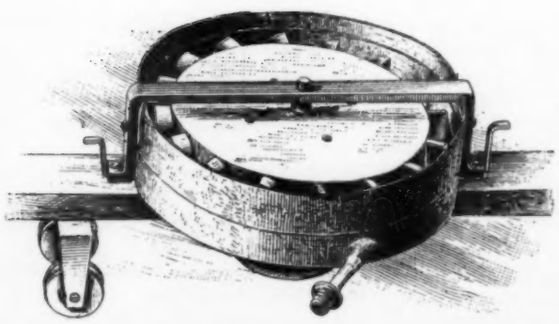


Fig 3.—Motor Inverted.

was to be had, thus succeeded in making a motor of 1/12 horsepower. This was sufficient to run an 8 or 10-inch fan, a small dynamo or other light machinery. Mr. Prindle in the Iron Age tells how the motor was constructed:

"The only available water power was that to be found in a fixed wash basin. This resulted in adapting the reaction wheel to a horizontal position to fit the necessity. The wheel consists of a horizontal cylinder on a vertical shaft, having nearly semicircular buckets on its periphery. The water is directed by the nozzle nearly tangential to the upper side of the bucket, and after traversing around the wall of the bucket it leaves in a nearly horizontal line in the opposite direction to that from which it entered. As the water leaves the bucket it drops slightly below the level of the wheel and falls into the basin, from which it passes off through the drain pipe. The wheel and casing are supported on a piece of wood that is ⅞ x 2 inches in section and 18 inches long. At a point 8½ inches from one end a hole ⅝ inch in diameter is bored to allow for the passage of the shaft. Five and one-half inches on each side of the hole for the shaft is a small hole to accommodate a screw threaded rod that is bent at a right angle at the lower end. By turning the bent end of each rod to engage the under side of the top slab of the wash stand and turning the nuts to draw up the rods, the piece of wood is securely clamped to the basin. A bearing is formed for the shaft by screwing to the wood two pieces of ¼ x ¾ inch iron that are 1½ inches long. Each piece of iron contains half of a ⅜-inch hole that is occupied by a neck on the shaft. The object in making the bearing in two pieces is to enable it to be placed around the neck of the shaft (this neck being necessary to prevent endwise motion of the shaft) and to allow of adjustment for wear. The shaft is ½ inch in diameter and 6 inches long. The lower end is reduced to ¼ inch in diameter for a distance of ½ inch. A neck ⅜ inch in diameter is turned for ¼ inch, beginning at a point 2 inches from the upper end. The lower end of the shaft is stepped in a stirrup that depends from the under side of the piece of wood. The stirrup is made of ¾ x ¼ inch iron, and a piece that is 15½ inches long is required. The feet by which it is attached to the wood are ½ inch in length, the vertical arms are 2½ inches inside measurement, and the horizontal cross piece is 9 inches long.

"The wheel, Fig. 2, is built up on a block of wood that is square for convenience. The sides are 4 inches in length, and the thickness is 1½ inches. A ½-inch hole is bored exactly in the center and perfectly at right angles to the sides of the block. Two disks of galvanized sheet iron 7 inches in diameter are cut and provided with ½-inch holes at the center. These disks are secured with round head screws to the block. A strip of the sheet metal 1½ inches wide and 22½ inches in length is bent into a hoop of the diameter of the disks, and its ends are soldered together. The hoop is then sprung over the disks, and is securely soldered at its edges to the peripheries of the disks. The hoop is now divided into 16 equal spaces by lines running across its face.

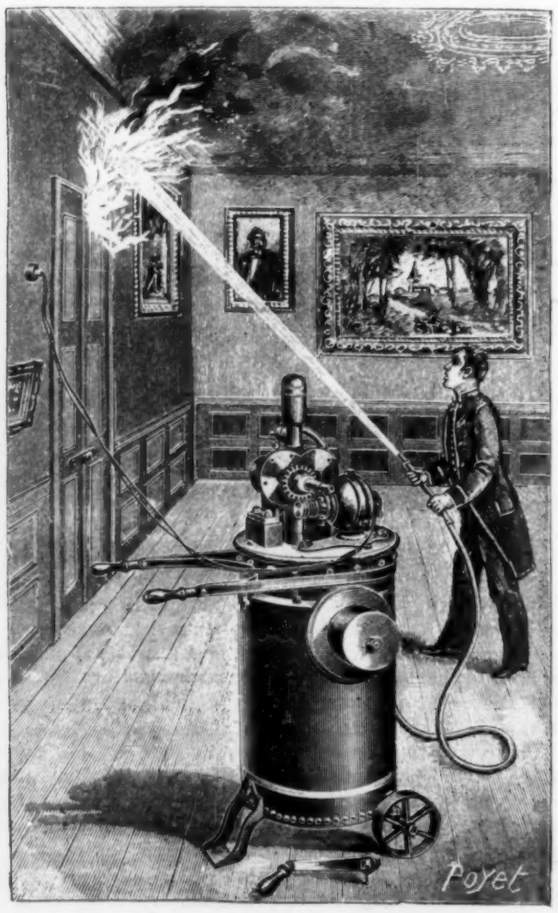
"To form the buckets, eight disks 1½ inches in diameter are cut from the sheet iron, and each disk is then cut in half. Strips of iron ½ inch wide and 2⅜ inches long are next soldered to the semicircular edges of the small disks. The buckets are then accurately placed on the lines that have been drawn on the hoop of the wheel and are soldered in place around the outside. A keyway is cut the entire length of the shaft and the wheel is keyed in place.

"To prevent splashing and to support the nozzles, a casing is necessary. This consists simply of a disk 9 inches in diameter having an apron 2½ inches deep that is soldered around the periphery of the disk. The length of the strip that forms the apron is 29 inches. The casing is screwed to the under side of the piece of wood and to the arms of the stirrup. To support the nozzles firmly in the somewhat yielding casing, two pieces of 3-16 inch brass tubing 1½ inches long are soldered into holes in the apron of the casing ¾ inch below the upper edges, and are set in a line that is tangential to a circle 7½ inches in diameter. The nozzles are taken from zinc oil cans such as may be bought anywhere for from 5 to 10 cents. With a bracket saw the nozzle is cut off to afford an opening of ⅛ inch. The nozzles are carefully soldered in the center of the short tubes. The screw threaded end of the oil can spout is convenient for attaching rubber tubing.

"A belt pulley 3¼ inches in diameter and ⅞ inch thick is bored to fit the shaft snugly, and is grooved in its face, as shown in Fig. 1. In assembling the parts, the casing is screwed to the wood; the shaft, having the wheel keyed on it, is passed through the hole in the wood from below and the stirrup is screwed to place. The screws which secure the casing to the stirrup arms are now put in, and with the keying of the belt pulley on the shaft the water wheel is complete. The longer end of the piece of wood is convenient for securing guiding pulleys for the belt. These pulleys run on shafts that have their ends riveted into two U-shaped strap iron supports. The smaller U-shaped piece is placed within the larger one, and the two are secured together by the shafts and by the screws which fasten them to the wooden support. With a head of water of 40 feet, a power amounting to about 1-12 horse-power was obtained, using only one nozzle."

ELECTRIC FIRE EXTINGUISHER.

A French inventor has devised a portable fire extinguisher for use in buildings in putting out small fires. The machine consists of a light metal tank on wheels, holding 30 gallons of water, to be wheeled about by the two handles shown in the cut.

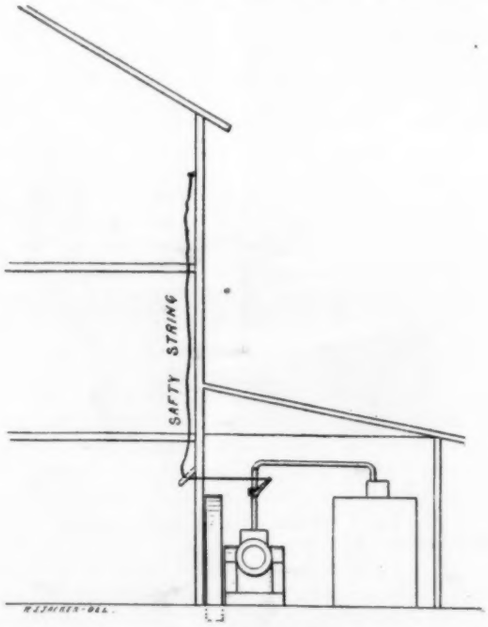


ELECTRIC FIRE EXTINGUISHER.

On the top of the tank is securely fastened an electric motor and pump. Power to work the pump is secured by removing one of the electric lamps, in the room, and attaching two wires by means of a screw plug. When the electric current is turned on the motor instantly works the pumps, throwing a good sized stream a distance of 30 feet.

ONE WAY "TO STOP THE ENGINE."

It is often desirable to stop the engine and sometimes the ability to do so may be the means of preventing a serious accident. A stout piece of twine running from the sawyer's lever



to each floor of the mill serves the purpose very well. For making turns in the string use of piece of 1x2½ or 3 with a ½-inch hole in it. Ream the edges of the hole and sandpaper it well so that it will not cut the string.—The American Miller.

VALUABLE ARTICLES OF RECENT DATE.

"The Effect of Cylinder Clearance Upon Steam Economy;" paper by Ira C. Hubbell, before the St. Louis Ry. Club.—Ry. Age, Dec. 13, 6000 words; illus.

"House Wiring for Telephones;" Electrical Review, Dec. 7, 3000 words, illus.

"Soldiering in the Jungles of the Sulus;" Railroad Trainmen's Journal, Dec., 1000 words, 6 illus.

"Poultry on City or Village Lots;" Am. Poultry Journal, Dec., 2500 words, 3 illus.

"Speed Regulation of Prime Movers;" The Practical Engineer, Dec., 1500 words.

"Estimation of the Cost of Sewer Construction;" Municipal Engineering, Dec., 5000 words, 3 illus.

"Molding a Large Shaper Bed;" Iron Molders' Journal, Dec., 3000 words, 6 illus.

"Late Gold Dredging Practice" (concluded); Mining and Scientific Press, Dec. 14, 1500 words.

"Review of Marine Engineering During the Last Ten Years;" Journal of the American Society of Naval Engineers, 13,500 words, 25 illus.

PAINT FOR STEEL PLATES.

One of the large railroad companies uses the following recipe in making an excellent protection for exposed steel plates:

Four pounds pure lamp-black ground in raw linseed oil, 7-8 gallon genuine asphaltic varnish, 1-4 gallon pure refined linseed oil, 1-4 gallon drying japan. One gallon of the paint will cover 350 square feet of surface.

An electric rack railway to cost over $4,000,000, will be built to the summit of Mt. Blanc.

HOW CAR WHEELS ARE MADE.

Chicago, The World's Greatest Producer, Makes Three Thousand Wheels a Day.

Think of it! Twelve and a half million car wheels, rolling along over the railroads of the United States, carrying the enormous tonnage of freight and passenger traffic requisite to the never ceasing stream of American commerce. These wheels transport about 1,500,000 freight cars and 38,000 passenger cars. To this collossal output of the past Chicago has contributed

MOLDING CAR WHEELS.

more than any other city of the world. The preponderance of her contribution will be even greater in the future.

Chicago now makes 3000 wheels every day or nearly a million a year. St. Louis enjoys the reputation of being next in importance to Chicago in this line of manufacture.

How are these car wheels made? This is a question that probably many an observant student of mechanics has asked. There are about half a hundred factories in the United States and while the general system employed by each is practically the same there is considerable variance in the mode of handling the metal, the methods of molding, shipment, etc. Many of the modern manufactories are so constructed as to enable the workmen to keep the product moving continuously in one direction.

The molding of a car wheel is precisely on the same principle as any ordinary casting. First the molds are arranged on the molding floor. Then the carefully selected iron is melted and poured therein. There are certain kinds of gray cast iron, which, when melted and poured against a metallic mold, the part of the iron next to the mold becomes hard, brittle and white, the interior portion remaining gray and fibrous. This change the outer rim of the wheel is made to undergo is called "chilling." The founders of past ages are believed to have discovered the property of chilling which certain iron possesses. It is known that parts of plows, faces of forged hammers, rolls for rolling metals, punches for punching holes in wagon tires, etc., and other kinds of implements, were chilled at an early day long before the advent of the car wheel.

The plates and hub of the wheel must be cast in a sand mold. They are thus made soft enough to be bored or machined, while the tread cast against a metallic mold is so hard that the finest tempered file will not affect it. The metallic mold in which the tread is cast is a good conductor of heat while the sand mold against which the hubs and plates are cast, is a poor conductor. Hence the cooling of the tread of the wheel by being cast against a metallic ring, technically called a "chiller," causes an undue strain on the wheel which must by some means be relieved or the wheel would be ruined. When the wheels are in condition to move from the molds they are placed in tight pits lined with fire brick that will stand the heat, ten or more in each pit. The equilibrium of heat between the tread and plates and hub, which has been destroyed by the rapid cooling of the tread by reason of the chilling process is restored as follows:

"Either by the development of latent heat, which occurs when so many hot pits are confined in tight pits, to extent sufficient to equalize the temperature of the different parts of the wheel; or

"By passing a current of cold air through the hubs of the wheels, which rapidly reduces the temperature of the center until it approximates that of the tread, or

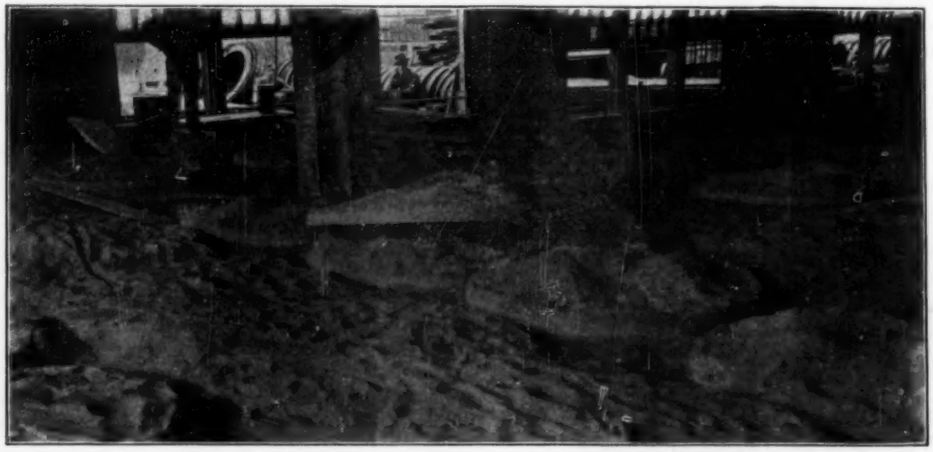
"By having the pits heated before the wheels are placed therein, and then by the application of additional heat rapidly raising the temperature of the tread until it approximates that of the plates and hub. The wheels are allowed to remain in the pits for several days and are not removed until all tendency to fracture from strain has been removed.

MOLDS READY FOR POURING.

To provide proper flange thickness on steel tired wheels, from 15 to 40 per cent must be turned off and thrown away.

In one of the big car wheel plants of Pittsburg ladle cars, each holding just enough iron for one wheel, distribute the

metal from the mixing ladle to the different molding floors. The cars are drawn by a wire rope driven by an electric motor. Each molding floor has an air hoist which lifts the red-hot wheel from there to another cable system in the rear of the floors and thence it is carried to the annealing pits. They are



ON TOP OF ANNEALING PITS.

then removed by air hoists to the cleaning floor, where both sides of the wheel are cleaned at once, by being run into a cleaning machine.

Each tap from the cupola to the mixing ladle is tested before it is poured into a mold. The test is to determine the chill or wearing quality of the iron and for this purpose a bar about two

ELECTRICALLY-DRIVEN CABLE SYSTEM WITH LADLE CARS.

inches square by five inches is cast with one side resting on a chill. This cools very rapidly and is assisted in doing so by being immersed in water, after which the test piece is broken. Test bars are poured at the same time with the test pieces to enable the exact strength of the iron to be obtained. Being finished the wheel is carefully tested for hardness, for thin plates, thick or thin flanges, shrinkage, cracks or any other possible defects. Then comes the testing by the railroads, the most severe of which is known as the Pennsylvania thermal system, which consists in surrounding the entire tread of the wheel with a band of molten iron 1¼ inches in thickness.

Illustrations from the Foundry.

AN AUTOMOBILE BAKERY.

The automobile craze is indeed far reaching. The latest is an automobile bakery. It was built in Rouen, says the Confectioners' and Bakers' Gazette. This new departure is to be found in the French army, and has been named the Schweitzer Military Bakery Automobile. A mill is with the bakery which will follow the regiments on the march and make fresh bread from the wheat on the spot. The mill is mounted on a car with the boilers and kneading troughs and all are run by the same motor as runs the automobile. The oven is separate, and is drawn along in the rear. The bran serves as food for the cavalry horses. It is estimated that this bakery will produce enough bread for 5000 men daily.

A ship canal to connect Lake Huron and Lake Erie is projected, and would save 150 miles of travel.

Certificates or licenses issued to marine engineers are graded according to class, first, second and third, which refers wholly to the vessel they are entitled to take charge of, not to the man's qualifications. Many engineers in subordinate positions have chief engineer's licenses.

HOTEL TELEPHONES SUPPLANT MESSENGER BOYS AND CALL BELLS—CHICAGO'S UNRIVALLED SYSTEM.

Guests of Chicago hotels may now remain in their rooms and talk to any person who has a telephone in any section of Chicago or in New York, Denver, St. Paul or any other city, for that matter. No longer is there the necessity of calling a messenger boy to deliver a few words to a social or business acquaintance. The guest may talk to the hotel clerk in person, or order anything he wants from any part of the hotel, without leaving his room.

This new convenience is brought about by the establishment of branch telephone exchanges in hotels, affording interior communication vastly superior to the familiar annunciator service.

"In Chicago," the Western Electrician says, "this work has been lately taken up in earnest by the Chicago Telephone Company, and at the present writing five hotels—the Auditorium, Auditorium Annex, Great Northern, Virginia and Windermere—are equipped for branch-exchange service. The Auditorium and the Annex are, however, served from one exchange, which is said to supply the largest hotel-telephone system in the United States. This exchange, illustrated herewith, is placed in the office of the Annex and may be described as a good example of the hotel telephone-extension idea.

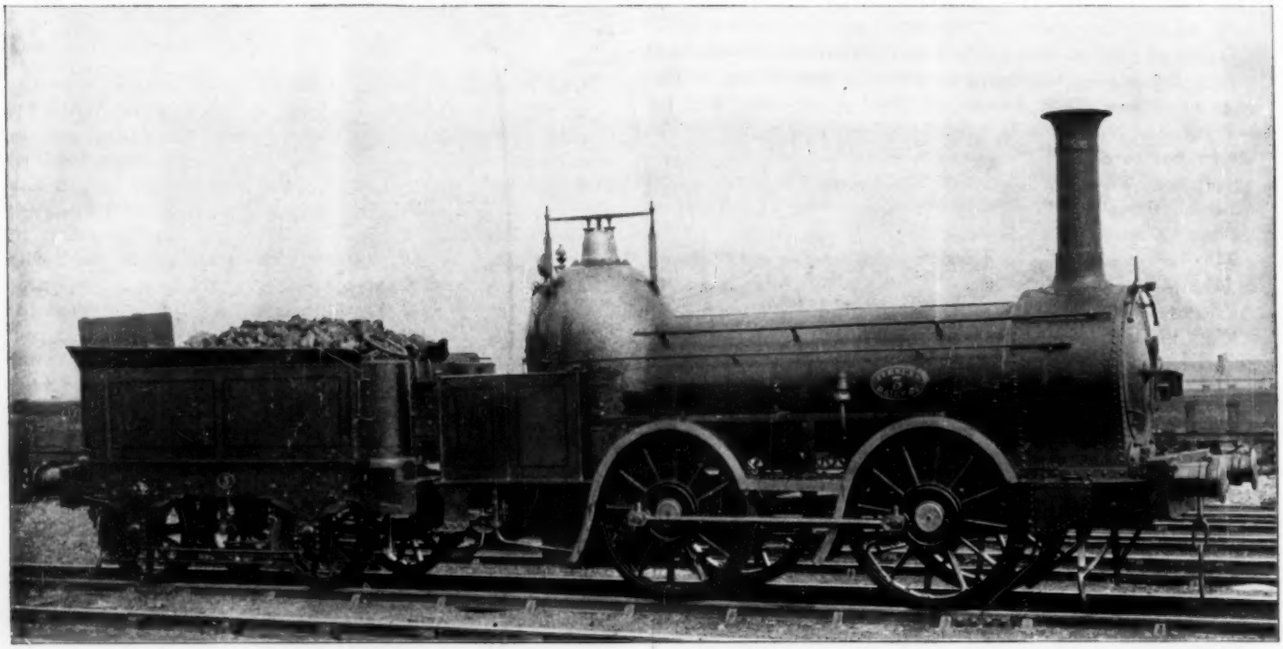
"The system at the Auditorium and Annex (and those at the other four hotels mentioned) is of the central-battery, automatic signaling type. Each guest's room or suite is provided with a telephone. The convenience in an obvious one and is appreciated. Does the guest wish a pitcher of ice water, a barber, a porter, a meal or some other creature comfort served in his room, he has but to call up the hotel exchange; the operator does the rest by making connection with the bell-boy station, the dining room, the bar, the barber shop, or what not. The advantages of the outside and long-distance connections are equally obvious.

"The Auditorium board, as shown in the picture, is located in an alcove immediately adjoining the office of the Annex and consists of one seven-panel section and one five-panel section, providing five operators' positions. At present about 900 lines from the two hotels terminate in this board, but it has an ultimate capacity of 1,200 lines. Somewhat out of the ordinary is the arrangements of the jacks at which the lines terminate. It will be noticed in the illustration that the multiple jacks with which the regular Chicago telephone switchboards are equipped have been dispensed with, and instead, local trunks between the different operators have been substituted, thus making it possible to "trunk" connections from one end of the board to the other. Nine of the 12 panels have each been fully equipped with 100 answering jacks, and each of these jacks has its customary line lamp, which is located directly below its jack. At the right side of each lamp a number plate is provided, upon which the number of the line—corresponding to the number of the room—which terminates in the jack above the lamp, is marked."

The X-ray affords an absolute proof of death. Professor Ottolenghi, of the University of Siena, says: "While it is easy to apply the rays to the lungs of a person who is alive or in trance, it is extremely difficult, indeed, practically impossible, to apply them to the lungs of a person actually dead." It is a simple test which can be made by any physician with the portable X-ray machine.

SECTION OF TELEPHONE SWITCHBOARD IN AUDITORIUM HOTEL, CHICAGO.

A LOCOMOTIVE CURIOSITY.



Fifty years is a long time in the history of railroading, but our illustration of an English locomotive shows one which has made the remarkable record of 53 years in service. It was built in Liverpool in 1846 and weighs, with tender, only 32 tons. The engine has cylinders 14 by 22 inches, carried a steam pressure of 120 pounds to the square inch and has a tube heating surface of 805 square feet and firebox heating surface of 49 square feet. The driving wheels are 4 feet 9 inches in diameter and the frames are of the bar type. The form of the firebox, characteristic of the Bury engines, and the fact that its material is copper had given it the descriptive nickname of "Old Coppernob" while it was in service. The boiler is 11 feet 2 inches in length and 3 feet 6 inches in diameter, the plates being of Low Moor iron throughout. The underframe is entirely of oak. It will now be placed on a pedestal and form a most interesting historical relic. —Railway Age, Oct. 25, 1901.

THE FIRE TEST FOR ORES.

In making the first test of ores supposed to contain gold or silver, a quantity of the ore is pulverized until it will pass through a 60-mesh sieve. In this condition the ore is called pulp. The Mining and Scientific Press describes the test as follows:

A half assay ton of the pulp is weighed carefully on the pulp scales and put into a crucible, together with a flux, which consists of carbonate of soda, borax and litharge, or protoxide of lead. Sometimes flour is added. The proportions of the ingredients in the flux vary according to the nature of the ore. Some heavy lead or galena ores require very little litharge. Other ores which contain little or no lead require litharge in larger quantities. The pulp and the flux are thoroughly mixed and covered with salt or borax. Borax makes a clearer flux, but has no other advantage over the common salt. If there is an excess of sulphur in the ore, iron nails are added. The crucible is then placed in the furnace, which has been heated to white heat to receive it.

The furnace contains a fireclay oven, a muffle, which is made with an opening at the back to permit the fumes from the crucible to escape. Usually half an hour or forty minutes is required to reduce the contents of the crucible to a fluid state. When the action in the crucible has ceased the contents are poured into a metal mold and allowed to cool. The slag is then broken off and a lead button is found at the bottom of the mold. This lead button contains all the gold and silver in the ore. To separate the gold and silver from the lead, the button is placed in a cupel, a small dish made of boneash, and replaced in the muffle. The lead is melted, and part of it passes off in fumes, while part of it is absorbed, together with any copper or other substances which may be in the bottom, by the boneash, leaving a small silver button in the cupel. If the ore is known to contain much silver, the lead button is placed in the cupel just as it is taken from the slag; but if there is very little silver in the ore, a known quantity of pure silver is added, so that there may be a heavy excess of silver in the button obtained in the cupel. This is necessary in order that the button may be parted with acid.

The silver button is weighed on the button balance, and is then parted by immersing it in nitric acid. The acid dissolves the silver and leaves the gold in the form of fine black dust. The parting is done in an annealing cup. The gold is washed and dried and the cup is placed in the muffle and heated to a red heat, which anneals the gold, bringing it into a compact mass and giving it its true gold color. The gold is transferred to the tray on the button balance and weighed. The weight of the gold is deducted from the weight of silver button, giving the weight of the silver. The button balance is a delicate piece of mechanism. It is kept in a glass case and the weighing is done with the case closed, in order that the air currents in the room may not affect the beam.

Swedish engineers are successfully working wireless telegraphs from the mainland to war vessels stationed at islands 28 miles away.

The buildings of the Pan-American Exposition are being wrecked by the Chicago House Wrecking Co., which paid $130,000 for them.

AN ELECTRIC BATON.

Electricity was used to beat time for many thousands of singers who could not see the musical director. The occasion was a local celebration of consequence in an English city. The crowd filled the streets on all four sides of the city hall and extended into side streets. Several bands were scattered to lead the multitude in singing the national anthem. An electric flash light was placed in front of each band leader, and the wires led to the stand where the general director stood and connected to his baton. At the beginning of every beat he pressed a button in his baton, which instantly flashed a light for each band leader, and thus the hymn was rendered simultaneously, and the experiment was a success.

DOES ELECTROCUTION KILL?

There is some doubt expressed as to certainty of instant death from electrical executions as now performed in Massachusetts and New York. There are so many cases of recovery of persons accidently shocked and apparently dead that there is good ground to doubt that the persons executed are killed by the electric shock alone. The law in New York requires an autopsy as soon as convenient after the execution. This being generally done immediately, there is a question whether electricity or the autopsy is the cause of death. This matter should receive a thorough investigation by a competent commission.

As long as capital punishment is to remain a law we should use the most humane but surest and swiftest methods possible. —Bubier's Popular Electrician.

NEW WAY TO ETCH ON GLASS.

A new method of etching on glass or porcelain has been patented by Herr Retzlaff of Berlin. The usual German process consists in cementing a sheet of tinfoil, and washing away of the cement. The improved plan is to perform this operation more simply and perfectly by chemical means. The pattern is printed or stenciled in grease colors on the tinfoil, which is then fastened to the glass by asphalt; and the prepared plate is placed in an acid bath that dissolves out the exposed parts of the foil. The asphalt is then washed off, when the glass is ready for etching in the usual way.

HOW TO USE THE WATCH AS A COMPASS.

Very few people are aware of the fact that in a watch they are always provided with a compass, with which, when the sun is shining, the cardinal points can be determined. All one has to do is to point the hour hand to the sun, and south is exactly half way between the hour and the figure 12 on the watch. This may seem strange to the average reader, but it is easily explained. While the sun is passing over 180 degrees (east to west) the hour hand of the watch passes over 360 degrees (from 6 o'clock to 6 o'clock). Therefore the angular movement of the sun in one hour corresponds to the angular movement of the hour hand in half an hour; hence, if we point the hour hand toward the sun the line from the point midway between the hour hand and 12 o'clock to the pivot of the hands will point to the south.—Engineer.

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REFERENCES—Chicago National Bank Chicago, Ill.; Planters' and Mechanics National Bank, Houston, Texas; The First National Bank of Beaumont, Texas.

WHAT THIS SYNDICATE OFFERS

It owns 437 acres of the choicest oil lands in Texas. Its first well on Spindle Top Heights, Beaumont, is now nearly completed. There are one hundred and ten gushers within a stone's throw of it—on every side. This well would have been completed before this except for the fact that for four weeks the drill was in the hardest rock yet struck on Spindle Top, and it took three weeks' drilling, night and day, to get through this forty-foot stratum. This was finally penetrated and the drill is now sinking rapidly. A gusher may be expected daily. This hard rock is an excellent indication of a big deposit of oil beneath it.

In addition to the Spindle Top Heights property, the Syndicate owns 400 acres at Sour Lake (within a few hundred feet of where a gusher has been struck), at Dayton Prairie, at Saratoga and elsewhere. Gushers are now in at Saratoga and Sour Lake and flowing perfect lubricating oil, making the proven oil fields of immense value. These lands are all paid for and owned outright by the Syndicate, therefore there are no leases and no royalties to pay.

A GUSHER GUARANTEED WITHIN THIRTY DAYS

This Syndicate guarantees a gusher on Spindle Top Heights within 30 days. A limited amount of treasury stock is offered for sale at 50 cents per share in lots of 50 shares and upwards. Money now subscribed for stock will be refunded directly to the subscriber if the Syndicate has not a gusher within 30 days. Out of town subscribers may deposit subscriptions in their local banks and notify this company at the address below.

MARKETING ARRANGEMENTS MADE

The demand for Texas oil is world wide and enormous. The only problem is to get the oil to the market. This problem has been solved by the Syndicate.

This Syndicate has just bought 20 acres of tankage ground, with 1,000 feet frontage on the railroad (The Texas and New Orleans Branch of the Southern Pacific), only 1½ miles from Spindle Top. This will give trackage for 30 tank cars that can be loaded at one time. Tanks and a pipeline from the Syndicate's wells to its tanks and loading racks will be built at once. This will give the Syndicate unexcelled facilities for marketing the products of its wells.

With these arrangements made, as soon as a gusher comes in, the property will be greatly enhanced in value, and

The price of the stock Will at Once Advance and will thereafter continue to go up rapidly ON MERIT ALONE

It is now offered at par—50 cents per share—the ground floor price. Dividends will be paid as soon as earnings begin. That time is not far off—BUY NOW. The company is managed by men of recognized ability and known integrity.

No preferred stock—all shareholders on absolutely the same basis. When you buy and pay for this stock you can never be to any more expense. It can never be assessed.

Send requests for extended prospectus, remittances for subscription or any information to

$25	buys	50	shares
$50	"	100	"
$100	"	200	"
$200	"	500	"

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CEMENT FOR REPAIRING CAST IRON TANKS.

A cement for repairing cast iron tanks is prepared by melting at a low heat (so as to prevent the brimstone catching fire) 5 parts of brimstone, 2 parts of blacklead and 2 parts of sifted cast iron filings. Before applying the cement warm the metal by laying a red hot iron over it. The metal must be perfectly dry, so as not to generate steam, and then stop up the damaged part with the cement applied in a soft state by gently heating it in an iron ladle.

Wants, etc., 3 lines 50 cents.

HELP WANTED.

WANTED MOLDERS, 25 to 50 bench molders. The Haven Malleable Castings Co., Cincinnati, Ohio.

CARRIAGE & WAGON WOOD WORKERS wanted. W. H. Gabriel & Son, 50 Michigan street, Cleveland, Ohio.

$1500 YEARLY—Introducing the latest improved and most perfect fire extinguisher; permanent position with exclusive territory to right party. Eagle Tool Co., D. 900, Cincinnati, O.

LADY TO TRAVEL and collect for manufacturer; salary $50 monthly to begin; send reference and addressed envelope at once. Treasurer, 702 Star Bldg., Chicago, Ill.

WANTED—A good wood-working machine hand; must be familiar with variety machine work. La Rose Mfg. Co., 172 Broadway, Albany, N. Y.

WANTED—Experienced weavers; also learners; also learners; young women preferred. Mayhew Silk Manufacturing Co., J. J. Huckley, Superintendent. Old Silk Mill, Ninth Av. and Twenty-fifth St., Altoona, Pa.

DRAUGHTSMAN—Architectural draughtsman; must be good on full size detail; permanent place for right man. William W. Sabin, 703 New England Bldg., Cleveland, Ohio.

WANTED EXPERIENCED CANVASSERS—Should clear $5 daily. Illustrated mechanical weekly, entirely new idea. Send references. Popular Mechanics, Journal Bldg., Chicago.

POSITIONS WANTED.

ENGINEER, competent on steam and electric plants, wants situation. Hunter, 108 Morris avenue, Newark, N. J.

YOUNG MINING ENGINEER, graduate of one of the best mining schools, desires position. Familiar with Colorado mining and milling practice. Several years' practical experience in assaying, mining and milling. Can assay, survey, keep books, etc. Speaks Spanish. Address R., 725 Kittredge Buildg., Denver, Colo.

WANTED—Situation; general all around machinist; no objection to leaving city. Address J. M. Graham Seabrooke, Dayton, Ohio.

DRAUGHTSMAN—Graduate, with 6 years' experience, wants position. Address Draughtsman, 1188 Willson Av., Cleveland, O.

SITUATION WANTED—In Indianapolis; young office man and correspondent; reference; cash security or bond. Langdon, 48 Dearborn St., Chicago.

BUSINESS CHANCES.

FOR SALE—One double saw mill complete with 60 and 30 saws. Address G. W. Startle, Osborn, O.

FOR SALE—Second-hand steam, gasoline, electric vehicles. Guaranteed. A. L. Dyke, Linmar Bldg., St. Louis, Mo.

BIG RETURNS, small investment; $150 to $500 month made selling the Wonderful Doren System Light; more brilliant than electric are; can be turned up or down at will. Write for terms to agents. Acorn Brass Works, Dept. P. M., Chicago.

TANKS WANTED—Anyone having iron tanks of 3,500 to 5,000 gallons capacity for sale, is requested to address X. Y. Z., Box 72, Albany, N. Y.

A SMALL INVESTMENT in new railroad and lumber company (road now building) will net you 31 per cent a year. Vanderbilt Timber Mining and Southwestern R. R. Co., 462 Bourse, Philadelphia, Pa.

WANTED STOCKS OF GOODS and all kinds of machinery, tools, store, office fixtures, etc. T. P. Westropp & Co., 305 Pearl St., Cleveland, Ohio.

FOR SALE—The Automobile Storage and Repair Co., 57 West 66th St., New York, have new and second-hand steam, gasoline and electric carriages constantly on hand and have always some special bargains.

FOR SALE—One nearly new 5 h. p. gasoline twin-cylinder automobile motor, water cooled, for $125.00. One single cylinder, water cooled, automobile motor, for $100.00. No more at this price. H. L. Hoffman Motor Co., Plainfield, Ill.

SIGNALING THROUGH PIPES.

From investigations made by Schale of the distance to which signals can be reliably conveyed through pipes, as in mines, it appears that straight pipe systems will carry the sound a long way, but that side branches are less reliable. He made experiments in Westphalian coal mines, using sprinkler pipes put up to lay the dust; these were mostly galvanized wrought iron pipes, one or two inches in diameter, suspended by wires or hooks, or placed in conduits, and connected by flanges, with rubber packing, or fitted into one another with hemp packing, the branches generally joining under right angles. Using first a funnel-shaped mouthpiece, it was found that the hands were a better help; slowly spoken words thus could be understood at the extremities of straight pipes 1600 feet long, especially when the pipes were firmly fixed. Whistle signals were much less distinct; tapping the pipes answered best, of course. Every side branch decreases the efficiency. Yet communication was fairly good, for instance, with a pipe 160 feet long, divided into two side branches, the main pipe being further continued through a connection containing a valve to two other side branches, each of the four branches having a length of 700 feet.

JOSHUA WAYBACK—"Automobeel, wuz it? I thought it wuz a hoss wagin goin' back end to, and this is th' furst I know sence!"

REMARKABLE ELECTRICAL DISPLAY.

An electric power transmission line is operating in California, carrying the enormous power of 30,000 volts from the Yuba power station to the Feather river dredgers. One of the wires recently broke loose, and a physician who was passing says it was a strange and weird sight to see the curves and bends of the wire, which resembled the motions of a fiery serpent. Now the wire seemed to whirl in immense circles, making the face of the country so bright that one could see to read a newspaper. It would strike a pool of water and the noise sounded like the mighty hiss of a gigantic reptile, while clouds of steam rose from the pool. Then it would hit the great green post to which the wires were fastened, and when it did, a sheet of flame 40 or 50 feet high would shoot up into the air. The motions and contortions of the wire were of such a character that one seemed fascinated and compelled to gaze upon it without the power to turn away.

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